

ENGLISH LANGUAGE TRANSLATION OF

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Title: Rotary transmitter

The invention relates to a rotary transmitter having a stator and a rotor which revolves concentrically with respect to the stator and from which signals which are received by a rotating body in particular by means of sensors can be transmitted to the stator. Known rotary transmitters of this type are used in order to reduce the contact resistances by means of contact disks which are immersed in mercury. This results in restrictions on the transmission channels, since the mercury cells occupy a very large amount of space. Furthermore, complex maintenance activities are required owing to dirt and amalgam formation. The invention improves the transmitters on the one hand by the sensor signals being processed in the rotating part of the device itself, and on the other hand by providing potential isolation between the rotor and stator by the supply power being input inductively, and by the signals for control purposes and for the measured values being transmitted by optical means. Owing to the lack of conductive transmission channels, the rotary transmitter operates with little maintenance and free of changing ground potentials and supply potentials.

DESCRIPTION

The invention relates to a rotary transmitter having a stator and a rotor which revolves concentrically with respect to the stator and from which signals which are recorded by a rotating body in particular by means of sensors are transmitted to the stator.

Rotary transmitters of this type are frequently required for transmission of measured values from the revolving part, such as rotating bodies. In this case, the technical development is largely aimed at avoiding or reducing transmission resistances. In order to avoid contact resistances, rotary transmitters have therefore been developed with liquid cells, to be precise in particular mercury cells, with isolated, axially separated contact disks in cells such as these being immersed in mercury, as described in the "Handbuch für elektrisches Messen mechanischer Größen" [Manual for electrical measurement of mechanical variables], Christof Ruhrbach, 1967, VDI-Verlag, Düsseldorf, page 342. In order to reduce the installation length which results from the axial separations, Patent Application DE 34 45 045.9 provides for the stator to be in the form of a central hollow shaft and for the rotor which revolves around it to be essentially inserted into the interior of the rotating body and to be secured in it, such that the entire device comprising a rotary transmitter with a rotating body to which the sensors are fitted is not significantly longer than the latter.

The known rotary transmitters with mercury cells have the disadvantage on the one hand that the mercury cells in the end remain numerically limited, and on the other hand that careful maintenance is required in order to make it possible to preclude changes to the mercury resulting from dirt and amalgam formation. In

principle, in the case of rotary transmitters such as these, the bonding to ground potential represents a danger to the transmission, since, in the absolute domain, fluctuations can occur in the ground potential.

5 A corresponding adverse effect can occur as a result of the bonding to the supply potentials, without which it would be impossible for the measured values to be passed on in the electrical domain. Since the signals are generally transmitted in analog form, they are
10 accordingly susceptible to interference.

Against the background of these difficulties, the invention is based on the object of providing a rotary transmitter which is largely free of adverse effects,
15 and in which there is no bonding either to the ground potential or to the supply potentials, and in which the signal transmission is accordingly free of the disturbance influences which have been mentioned. A further aim is to reduce the maintenance effort.

20 This object is achieved by the proposal made in patent claim 1, which is further refined in an advantageous manner in the dependent claims 2 to 8.

25 The potential isolation between the rotor and the stator means that no external voltages, which otherwise occur in an uncontrolled manner during operating conditions, can influence the measured values. In fact, the latter are expediently processed in the rotating
30 part of the device, that is to say possibly in the rotating body and in the rotor. The potential isolation that is provided between the rotor and stator governs the form of the measured value transmission according to the invention.

35 The signal processing to be carried out in the rotor-side part of the device is dependent on a power supply which originates from the stator. For the purposes of

the invention, this power supply is in an inductive form, so that no potential can be transmitted from the stator to the rotor.

5 It is particularly appropriate to arrange a shell core transformer between the rotor and the stator, whose primary winding is located on the stator side and whose secondary winding is located on the rotor side. An AC voltage whose frequency is sufficiently high to make it
10 possible to transmit the required power with the desired physical size is chosen for operation of the transformer. The use of the two parts of the shell core transformer which are spaced apart from one another makes it possible to use its shaft for further
15 transmission.

The rotor-side measured value processing comprises at least charge amplification by means of appropriate charge amplifiers, which can generally be arranged in
20 the rotating body itself. This approach is based on active sensors which are normally used as force measurement sensors, particularly according to DE-C 26 30 410, in order to record the voltage distribution of flexible steel strips in the case of
25 cold rolling using a deflection measurement roller. Transmitters such as these are, according to the invention, connected to at least one charge amplifier which belongs to the rotating part. Its output is connected to a telemetry transmitter that is located in
30 the rotor and which provides optical transmission, without any contact, to a receiving unit which belongs to the stationary part.

Pulse code modulation is used particularly
35 advantageously for transmission of the measured values. A large number of measured values can thus follow in a data stream at time intervals which may then be associated with different channels. Accordingly, the

charges (which are produced, for example, by means of piezo-crystals) are first of all converted in the charge amplifier to direct currents or DC voltages. These form the input for a multiplexer, via which
5 (after filtering and A/D conversion as well as PCM conversion) a transmission diode is controlled, which is located axially in the secondary part of the already mentioned shell core transformer. The transmitted values are received by a receiving diode which is
10 located in the shaft of the primary part of the shell core transformer, and they are passed from there to a PCM interface.

A controller, which is initiated on the stator side via
15 a transmitter, is used for such signal processing. For this purpose, a further transmission diode transmits control data optically, and this control data is decoded on the rotor side in order in this way to drive the signal detection unit (charge amplifier).

20 In a further refinement of the invention, the power supply which is taken from the secondary part of the shell core transformer is subjected to voltage processing in the rotor such that the positive and
25 negative voltage limits are defined.

For this purpose, it is advantageous to provide the central optical receiving diode on the rotor side at an axial distance from the shell core transformer and,
30 furthermore, to provide a circumferential ring of equidistantly distributed transmission diodes on the stator side, which can be acted on by means of a digital, adjustable controller. Advantageous coverage of the light signals during one revolution can thus be
35 achieved by means of twelve transmission diodes arranged in a manner such as this.

The proposed drive by means of transmission diodes which are arranged on a ring on the stator side ensures that transmission always takes place precisely, irrespective of the mechanical angular position between the stator and rotor. Since the transmission is intended to be independent of the angular position, each of the twelve transmission diodes are operated with the same signal. This is driven on the basis of the gain ranges of the charge amplifier or amplifiers. The diode ring is thus used to determine the gain applied to the measurement signals. The charge amplifier or amplifiers can thus be reset and, on the other hand, can be set to different voltage gain ranges which correspond to specific signal codes which are received by the receiving diode. From there, the signals are also passed to decoding logic, in order then to be passed via the wiring in the rotating part of the device to the charge amplifier or amplifiers. The signal flow passes from the evaluation electronics via the diode ring to the receiving diode, and from there in turn conductively to an electrode which also moves, and which is connected to the charge amplifier via a plug. The connections in these parts are likewise conductive.

The non-contacting transmission channels lead either from the circumference to the center or from the center to the center. In this way, the rotor and the stator are isolated in conjunction with the power supply to be transmitted by means of the shell core transformer, thus fully achieving the object according to the invention. One application of the new rotary transmitter is, in particular, in conjunction with the already mentioned deflection measurement roller according to DE-C 26 30 410.

In order to illustrate the invention further, reference is made to the drawing, which relates to one exemplary embodiment:

5 A stator 1 is illustrated by means of dashed lines in the right-hand part of the drawing. On the input side, an interface 2 can be seen for a digital control signal, a further interface 3 for power transmission, and an interface 4 for pulse code modulation. The
10 primary, stationary part 6 of the shell core transformer is arranged at the bottom of a holding chamber 5, and the receiving diode 7 is inserted in its hollow shaft. The winding which belongs to the primary part 6 of the shell core transformer is fed from the
15 interface 3, while the receiving diode 7 is connected to the pulse code modulator 4.

A cylindrical projection 8 of the rotor 9 (which is likewise illustrated by dashed lines) projects into the
20 chamber 5. The secondary, rotating part 10 of the shell core transformer is inserted into the end surface of the cylindrical projection 8. The stationary part 6 and the rotating part 10 are, apart from this, aligned coaxially with respect to the system axis, so that the
25 respective windings are opposite. In particular, the centrally inserted transmission diode 11 is aligned with the receiving diode 7. A serial data stream which contains the coded measured values is transmitted via this transmission diode. This data stream is received
30 by the receiver diode 7, and is passed to the PCM interface 4.

The interface 2 for the digital control signal acts on the transmission diodes 12, which are arranged
35 equidistantly in the form of a ring, and whose signals are received by the rotor-side receiving diode 13 during rotation of the rotor 9. The transmission

between the stator and the rotor is thus ensured with regard to controlling the charge amplifiers.

5 A power oscillator, which is not shown in the drawing, is provided for the power supply. The shell core transformer is operated from this power oscillator with a voltage of 30 volts and with a current level of 1.5 amperes at a frequency of 250 kHz. The inductively transmitted power is supplied conductively from the
10 rotating part 11 of the shell core transformer to the feed voltage processing 14, which provides the power supply for, for example, the connected measurement roller, by predetermining the positive and negative voltages with respect to ground potential.

15 The control signal which is received by the receiving diode 13 in the manner which has already been mentioned is passed to the digital control signal processing 15, and from there is used to drive the charge amplifiers
20 for the measurement roller.

Finally, the modules for measured value transfer and processing are also arranged in the rotor 9. First of all, the large number of input signals are passed as
25 analog values to the multiplexer 16. The data stream then passes via the filter 17 to the A/D converter 18, and from there to the PCM converter 19, which applies the data stream to the transmission diode 11.

30 The arrangement of the modules as in the schematic illustration described above has been proven in practice. The modules 14 to 19 are accordingly accommodated in the rotor, which is expediently inserted into an axial retaining hole in a measurement
35 roller or the like.

The rotary transmission as described above allows the processing of a very large number of signals. It can

cope without any difficulties with a frequency of 10 MHz, thus ensuring the validity over the values to be measured with very high precision.

Patent Claims

1. A rotary transmitter having a stator and a rotor which revolves concentrically with respect to the stator and from which signals which are received by a rotating body in particular by means of sensors are transmitted to the stator, distinguished by the sensor signals being processed in the rotating part of the device itself,
5 and by potential isolation between the rotor (9) and the stator (1).
2. The rotary transmitter as claimed in claim 1, distinguished by a power supply for the rotor-side signal processing which can be fed in from the stator
15 (1) inductively, without any contact.
3. The rotary transmitter as claimed in claims 1 and 2, wherein a shell core transformer (6, 10), which is concentric with respect to the rotor axis, is provided
20 for the inductive input, its primary winding is connected to the stator (1) where it has an interface (3) for its electrical supply, while its secondary winding is connected in a corresponding manner to the rotor (9), with which the secondary part (10) revolves
25 concentrically.
4. The rotary transmitter as claimed in claims 1 to 3, wherein the transmitters which are in the form of active sensors are connected to at least one charge
30 amplifier that is associated with the rotating part and whose output is connected to a telemetry transmitter (16, 17, 18, 19) which is located in the rotor (9) and via which optical transmission takes place, without any
35 contact, to a receiving diode (7) which is part of the stator.

5. The rotary transmitter as claimed in claims 1 to 4, wherein there is also a transmitter on the stator side for control data which is to be transmitted optically on the rotor side and which is decoded on the rotor side in order to drive the signals to be transmitted.

6. The rotary transmitter as claimed in claims 1 to 5, wherein the measurement signals from the sensors are recorded by a multiplexer (16) after their charge has been amplified in the rotor (9), the output of which multiplexer (16) is supplied, after filtering, via an A/D converter (18) to a PCM converter (19), from where, as a serial data stream, it controls a transmission diode (11) which is located centrally in the secondary part (10) of the shell core transformer, following which it is received by a receiving diode (7), which is located in the primary part (6) of the shell core transformer, and is passed to a PCM interface (4).

7. The rotary transmitter as claimed in claims 1 to 6, wherein supply voltage processing in the rotor (9) for the power supply which is received by the secondary part (10) of the shell core transformer is carried out in such a way that the positive and negative voltage limits are defined.

8. The rotary transmitter as claimed in claims 1 to 7, wherein a centrally revolving, optical receiving diode (13) is provided for controlling the charge amplifier or amplifiers for the signals to be measured on the rotor side, and a circumferential ring of equidistantly distributed transmission diodes (12) is provided on the stator side, which can be acted on by means of a digital, adjustable controller (interface 2).

